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(54) Remote control of electrical appliances via the mains supply

(57) A handset IR1 communicates via an infra-red or other electro-magnetic or acoustic link with a terminal 6 which transmits a mains borne data packet to another terminal such as bus controller terminal 10. An electrical appliance such as lamp 1, lamp 3 or heater 4 is controlled by mains borne data packets sent by the controller 10. The system has a modem link 21 to the telephone system and handset IR1 also has a telephone modem so that a single handset can control the appliances within the household via the electro-magnetic or acoustic link or out of the household via the telephone link.

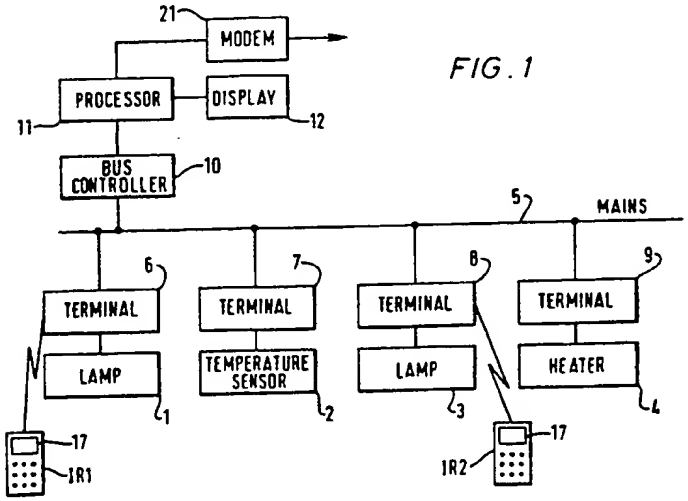
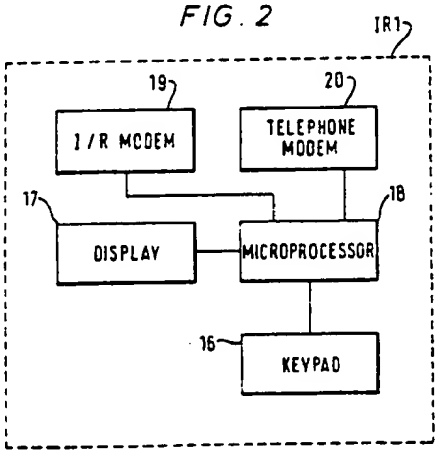


FIG. 1

FIG. 2



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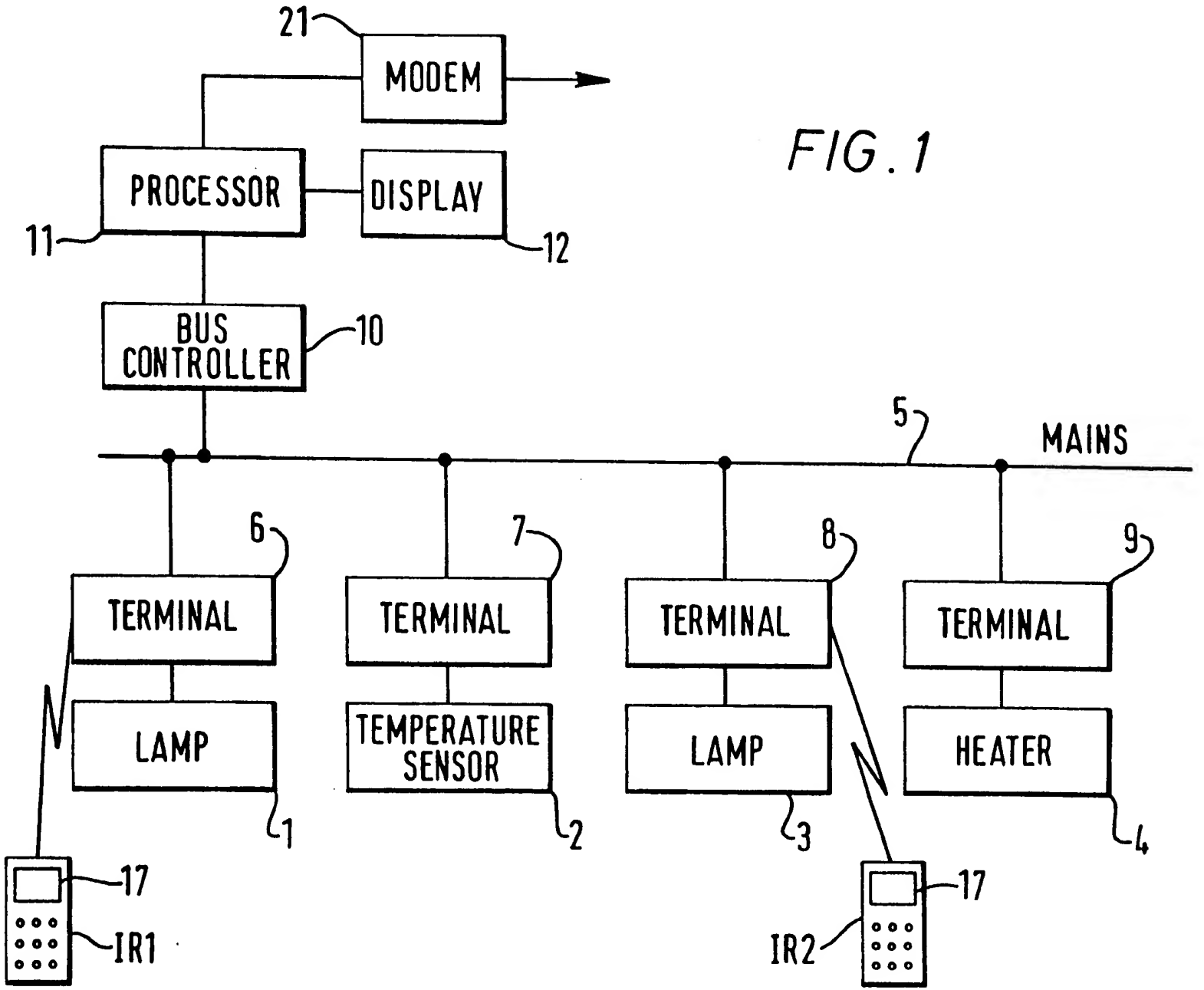
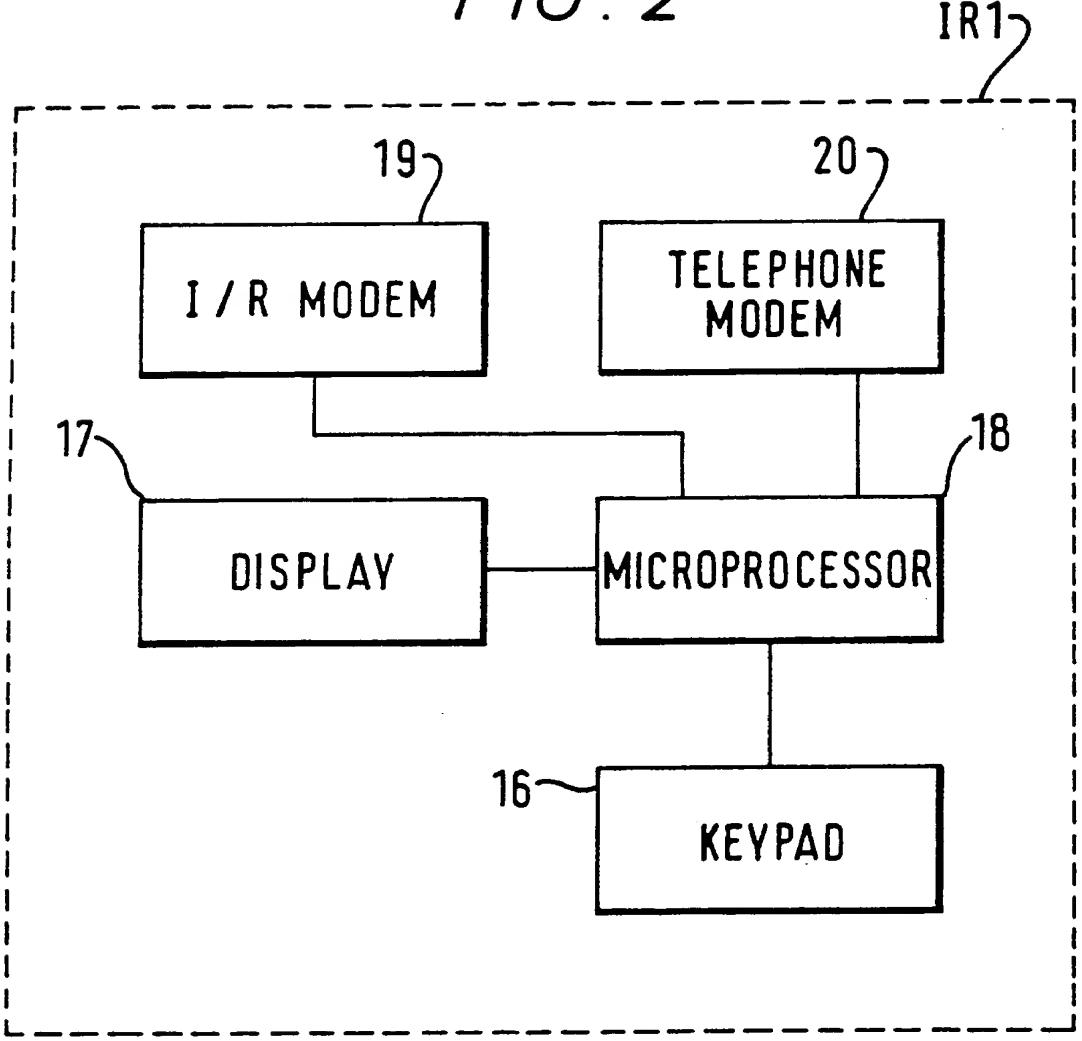

21
MODEM
PROCESSOR
DISPLAY
11
12
BUS CONTROLLER
10
5
MAINS
6
7
8
9
TERMINAL
TERMINAL
TERMINAL
TERMINAL
LAMP
TEMPERATURE SENSOR
LAMP
HEATER
1
2
3
4
17
IR1
17
IR2

FIG. 1

FIG. 2


IR1
19
20
I / R MODEM
TELEPHONE MODEM
17
18
DISPLAY
MICROPROCESSOR
16
KEYPAD

Controlling Remote Electrical Appliances Via The Mains Supply

This invention relates to remote control of electrical appliances via the mains supply, and especially to a handset for communicating with a terminal for causing a mains borne data packet to be transmitted to control the electrical appliance.

It is known to control electric lights via terminals which receive mains borne signals, wherein a user has a handset which can communicate with a terminal via an infra-red link.

In the applicant's co-pending patent application nos. 89 05082.7 and 89 05083.5 (P/8086/CRE and P/8087/CRE), a controller terminal transmits mains borne data packets and a plurality of remote terminals control the electrical appliances in response to receipt of such data packets. One or more handsets are able to commence transmission of data packets at respective defined times after the end of a message. The controller is driven by a micro-computer, into which messages can be fed from a

touch-sensitive display. It would in principle be possible to communicate with the micro-computer via a modem and a telephone link. This could be done using a further handset, which would need to have a modem to communicate with the telephone system.

The applicants have realised that certain components for such a handset would duplicate those for the infra-red handset for signalling to the terminals in the household having the electrical appliances.

Accordingly, the invention provides a handset for communicating with a terminal for causing a mains borne data packet to be transmitted to another terminal to control an electrical appliance remotely, comprising a display, a key pad, a micro-processor, a modem for communicating with a terminal via electro-magnetic or acoustic waves, and a modem for communicating with a terminal via a telephone link.

Such a handset can be used for communicating with the terminals via an electro-magnetic or acoustic link or via a telephone link. The modem for communicating via a electro-magnetic or acoustic waves could include an ultra-sonic link but preferably includes an infra-red link. The modem for communicating via the telephone link may have a plug or socket for communicating with telephone wires directly, or it may incorporate an acoustic coupler which can be connected to a telephone handset.

The invention also provides a system for the remote control of electrical appliances via the mains supply, comprising a controller terminal for transmitting and receiving mains borne data packets and a plurality of remote terminals for controlling the electrical appliances in response to receipt of data packets from the controller, and a handset for communicating via an electro-magnetic or acoustic link with a terminal to cause transmission of a mains borne data packet to control an appliance, the handset also being capable of communicating with the controller terminal via a telephone system.

The invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of apparatus for controlling remote electrical appliances via the mains supply; and

Figure 2 is a block diagram of the main components of the handsets shown in Figure 1.

Referring to Figure 1, a number of electrical appliances such as a lamp 1, a temperature sensor 2, a lamp 3, and a heater 4 are connected to the mains supply via respective terminals 6 to 9. Two of the terminals 6, 8 are provided with infra-red transmitter-receivers (not shown) to communicate with handsets IR1, IR2 also provided with transmitter-receivers. The terminals each include micro-processors which control the electrical appliances in accordance with data packets received from a bus (mains) controller terminal 10 which also includes a micro-processor, and which is in turn controlled by a micro-computer 11, which incorporates a display 12. The handsets IR1, IR2 also incorporate micro-processors, and terminals 6, 8 each include two

micro-processors each, one for processing the infra-red signals communicated between the terminals and the handsets, and the other for receiving signals from and transmitting signals onto the mains. Frequency shift keying (FSK) is used for the mains signalling frequencies being 130 or 134 kHz, and data can be transmitted and received at a rate of up to 2400 bits per second.

In a condition of high bus activity, messages will be transmitted by the controller terminal to respective remote terminals and, after predetermined delays, responses will be sent out by the respective remote terminals, The messages will be queued in the micro-computer 11 and fed to an internal queue in the controller 10 in turn at appropriate intervals. Thus, message 1 could be an instruction to turn lamp 1 on and message 2 could be an instruction to read temperature. In each case, the message duration is 15 bytes (8 bits to a byte) although the message could be up to 43 bytes long. A message specifies where the message is being sent from, the destination to which it is being sent, and the data content representing the operation to be performed. After the message 1 is transmitted by the controller, each terminal receives it and start

decoding it to ascertain if it is intended for that terminal. As soon as its terminal has decoded the signal sufficiently to ascertain that it is not intended for that terminal, it discards the remainder of that message.

When the terminal for which the message is intended confirms that the message is intended for itself, and after the message has itself ended, that terminal transmits, after a delay of 22 bytes from the end of the message, a response to the controller to confirm the message has been received. The response is in the same format as the message i.e. address of originating terminal, address of destination terminal and data content, and also lasts for a duration of 15 bytes (but could be up to 43 bytes long).

The other terminals will also receive the response, and will discard them when they have read its destination address, so that only the controller will make use of the data in it. After a delay of 22 bytes from the end of the response, the next message is sent out, and this could be for example an instruction to read temperature sensor 2.

The regular transmission of messages and receipt of responses only applies of course in a period of high bus activity eg. when the micro-computer 11 and the controller 10 are holding a stack of messages to be sent out. In a situation of low bus activity dummy messages of length 16 bytes are sent out at regular intervals, this time spaced by the longer interval of 87 bytes. The messages preserve the structure of the normal messages but do not result in any operation being performed on any appliance. The purpose of these dummy messages is to maintain synchronisation of the terminals, each of which has its own clock capable of being re-synchronised to incoming messages.

In either case of high or low bus activity, it will be noted that a delay follows each message or dummy message. This is made use of in the following way. Various given times in the delay are allocated to various functions to enable the controller to receive messages in the delay period. Further details of the use of such time slots is given in our co-pending application No. 89 05082.7 (P/8086/CRE). Further details of the synchronisation of the messages with each other is given in our co-pending application No. 89 05083.5 (P/8087/CRE).

Particular time slots are allocated to the various handsets IR1, IR2, and these can communicate with any terminal with infra-red transmitter receiver, and the message will be held in that terminal until the next time that slot appears after the end of a message on the mains.

Referring to Figure 2, the handset comprises a key pad 16 and a display 17 which are controlled by a micro-processor 18. The micro-processor is also connected to an infra-red modem 19 and a telecommunications modem 20.

When the handset is in the vicinity of the terminals 6 to 9, for example, when the handset is in a household, messages can be entered on the key pad and will transmitted to the terminals via the infra-red modem 19 and the infra-red link to the respective terminals.

When the user is out of the household and desires to communicate with the system in the household, the handset is coupled to a telephone handset since the handset has a built-in acoustic coupler, and messages

entered into the key pad 16 are transmitted via the telecom modem 20 which communicates via the telephone system with modem 21 connected to the micro-computer 11.

Thus, it is possible to control electrical appliances in the household from within the household using the infra-red link and from outside the household using the telephone link, and in each case the same handset is used. In practice, a number of handsets would be used in a household eg. IR1, IR2, and one of these would also have the telephone modem enabling it to be used outside in conjunction with a telephone. Apart from the convenience of having one handset instead of two, only one display, key pad and micro-processor are needed instead of two of each of these components if a separate handset was used for infra-red communication and for telephone communication.

CLAIMS

1. A handset for communicating with a terminal for causing a mains borne data packet to be transmitted to another terminal to control an electrical appliance remotely, comprising a display, a key pad, a micro-processor, a modem for communicating with a terminal via electro-magnetic or acoustic waves, and a modem for communicating with a terminal via a telephone link.

2. A handset as claimed in claim 1, in which the modem is arranged to communicate with the terminal via infra-red radiation.

3. A handset as claimed in claim 1 or claim 2, including an acoustic coupler for connection to a telephone handset.

4. A handset substantially as herein described with reference to the accompanying drawings.

5. A system for the remote control of electrical

appliances via the mains supply, comprising a controller terminal for transmitting and receiving mains borne data packets and a plurality of remote terminals for controlling the electrical appliances in response to receipt of data packets from the controller, and a handset for communicating via an electro-magnetic or acoustic link with a terminal to cause transmission of a mains borne data packet to control an appliance, the handset also being capable of communicating with the controller terminal via a telephone system.

6. A system for the remote control of electrical appliances via the mains supply substantially as herein described with reference to the accompanying drawings.

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